Weather, seasonal and decadal forecasts for the energy sector

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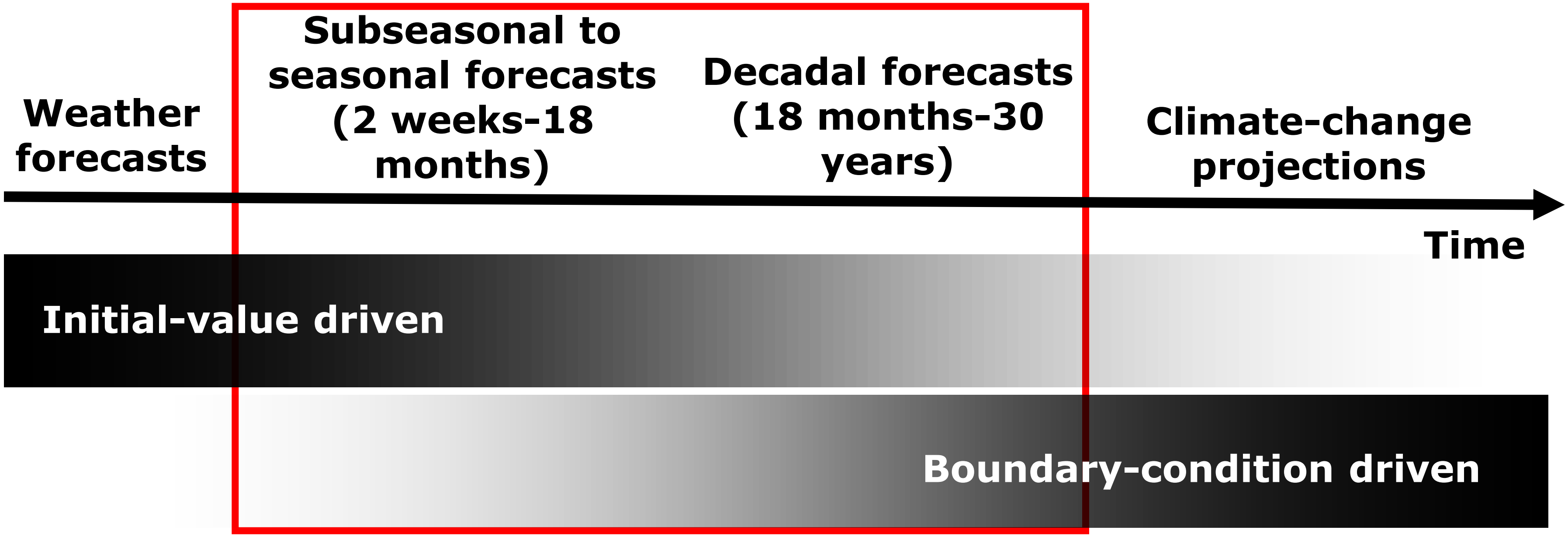
SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

iCrea BSC IC3

Climate prediction

Progression from initial-value problems with weather forecasting at one end and multi-decadal to century projections as a forced boundary condition problem at the other, with climate prediction (sub-seasonal, seasonal and decadal) in the middle. Prediction involves initialization and systematic comparison with a simultaneous reference.

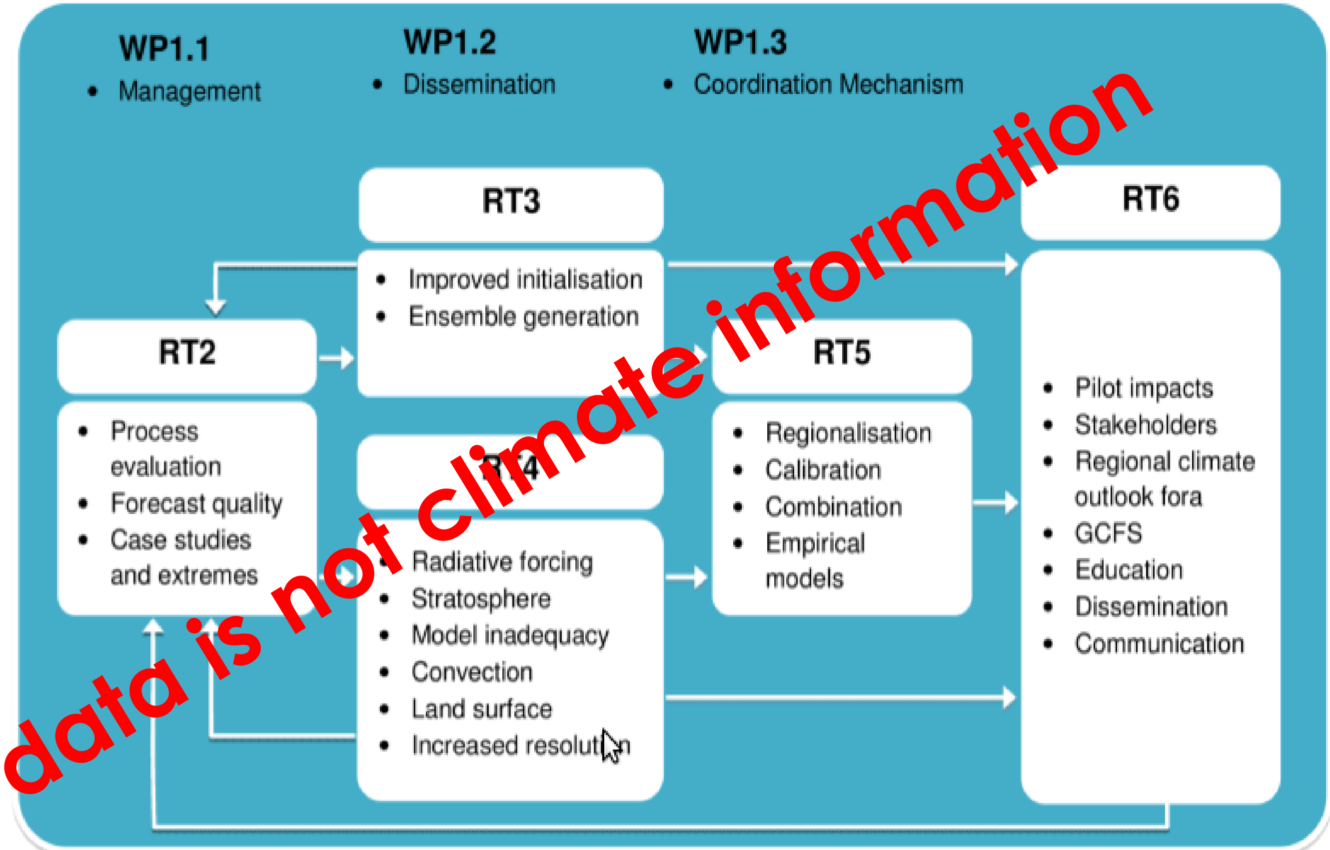


Adapted from Meehl et al. (2009)

SPECS overall strategy

Links to EUPORIAS/NACLIM (**ECOMS**), but also IS-ENES2, PREFACE, EUCLEIA, CLIPC, …

Forecast System	Project Partners
CNRM-CM5	CNRM, CERFACS
EC-Earth	KNMI, SMHI, IC3, ENEA
IFS/NEMO	ECMWF, UOXF
IPSL-CM5	CNRS
MPI-ESM	MPG, UniHH
UM	UKMET



WP1.1: Management
WP1.2: Dissemination
WP1.3: Coordination across EUPORIAS, NACLIM & SPECS
RT2: Evaluation of current s2d forecast systems
RT3: Forecast strategies
RT4: Improved systems
RT5: Calibrated predictions at the local scale

Climate data is not climate information

EUPORIAS principles

Services for wind energy

The energy sector requires:

- Forecasts for locations where the mean is large (wind speed above a threshold), and both variability (something to predict) and skill (something useful to say) are high
- Need energy generated over a period (month, season, etc), with uncertainty estimates, at the wind farm level
- Information for off-shore maintenance (~3 weeks lead time)
- Also consumption in other regions to balance network

Weather and climate forecasters have to deal with:

- Better understanding of the impact models, and the best way to adapt them to the useful climate information available
- Scarce observations
- Calibration (statistical properties mimic those of the data measured at the wind turbine height) and combination
- Downscaling, if necessary
- Documentation (use the IPCC calibrated language), demonstration of value, outreach

Services for wind energy

Pre-construction decisions:

- **EDPR, wind farm planners:** Optimising site selection to account for the medium- to long-term
- **Iberdrola, wind farm investors:** Evaluate return on investments, maximise loan rates
- **National and EU policy makers:** Understand changes to energy mix, impact to energy security/stability

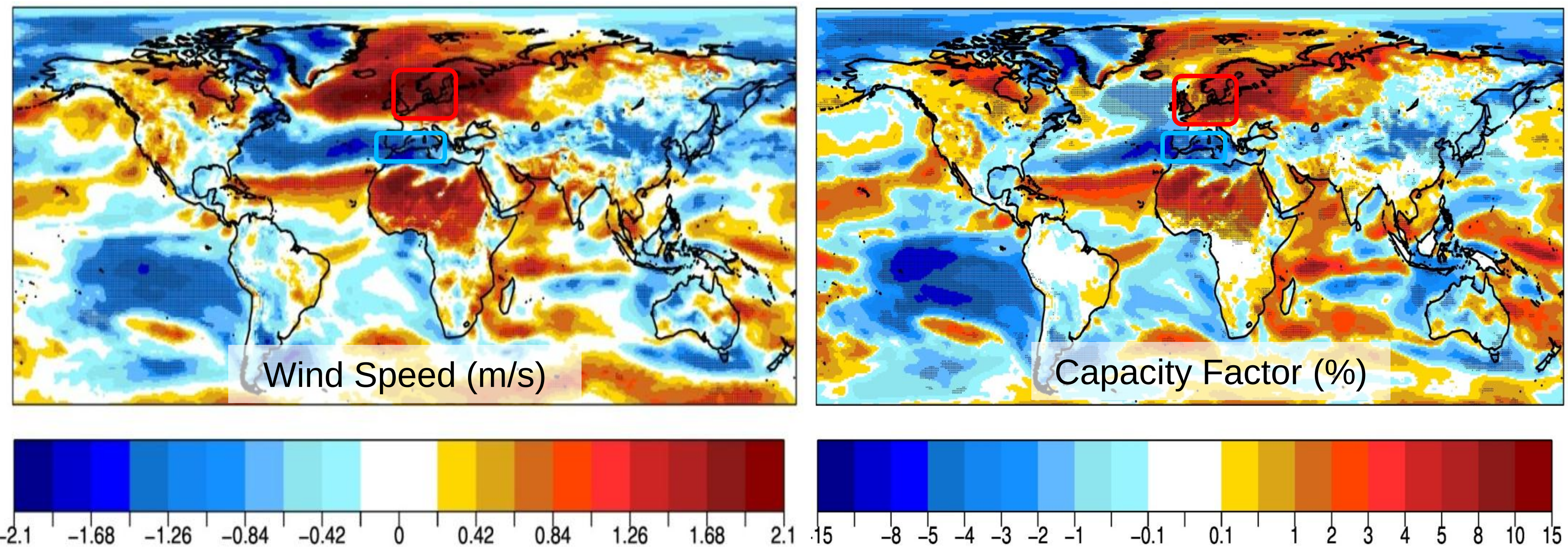
Post-construction decisions:

- **EDF, energy producers; RTE, grid operators:** Wind resource management for improved grid operations
- **Marexspectron, energy traders:** Wind power resource effects on financial markets
- **Alstom/GE, wind farm developers and operators:** Optimise planning for maintenance works
- **GE, wind farm investors:** Optimise return on investments, manage risk of low return periods

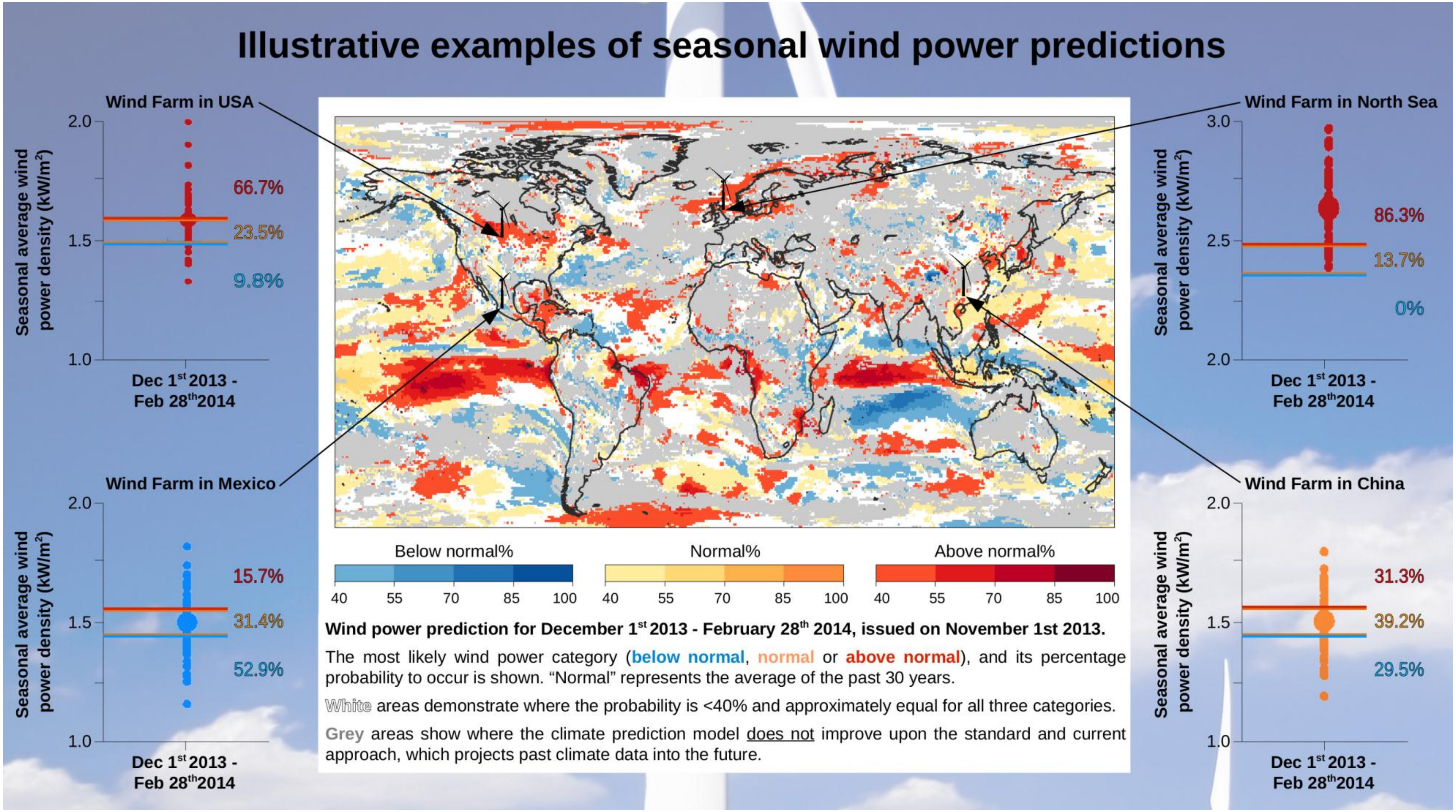
Resource seasonal variability

Difference in winter (DJF) standardised 10-metre wind speed (left) and capacity factor (right) for seasons with above normal and below normal North Atlantic Oscillation index.

Daily capacity factor (%) calculated from ERAInterim 10-metre wind speed and temperature data using an idealised power curve, a log scaling law to transform the wind to hub height wind, and a Rayleigh distribution to model diurnal variability.



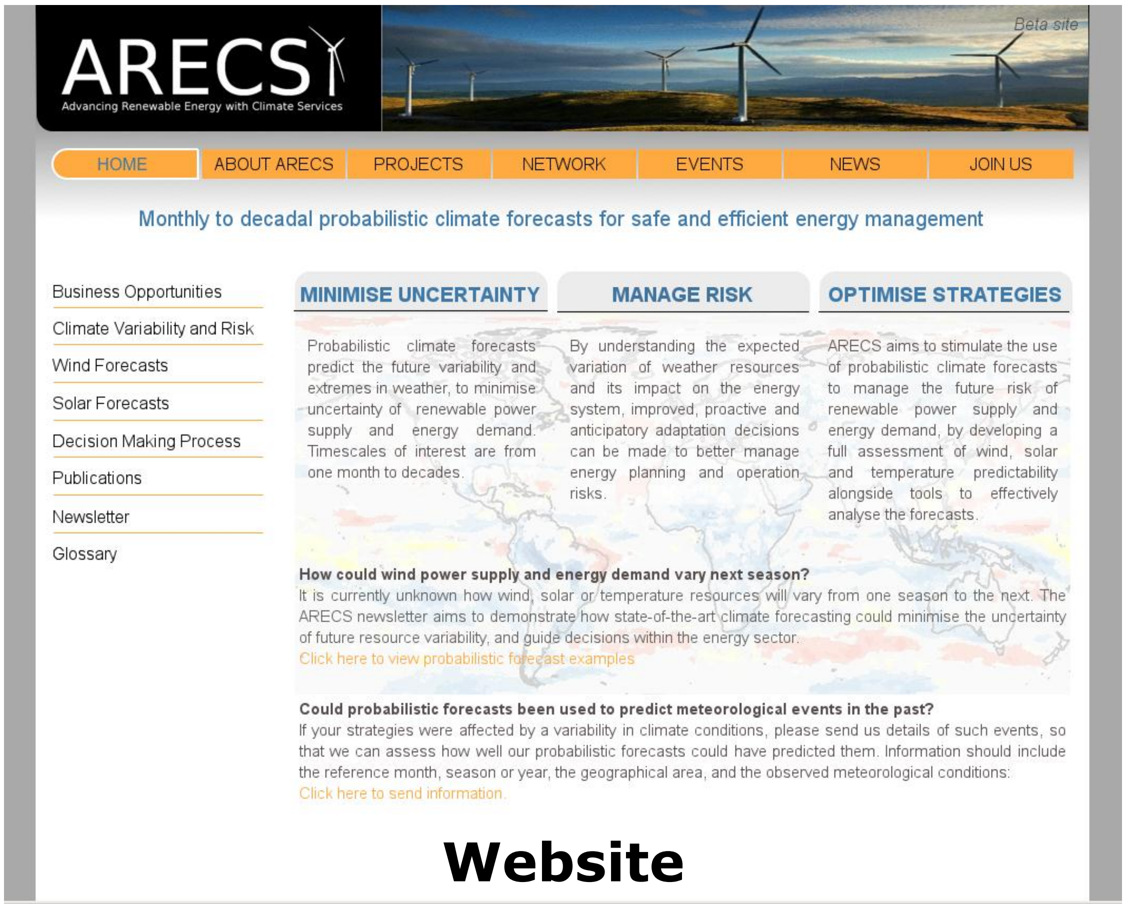
Seasonal wind power prediction



The service

Advancing Renewable Energy with Climate Services (ARECS)

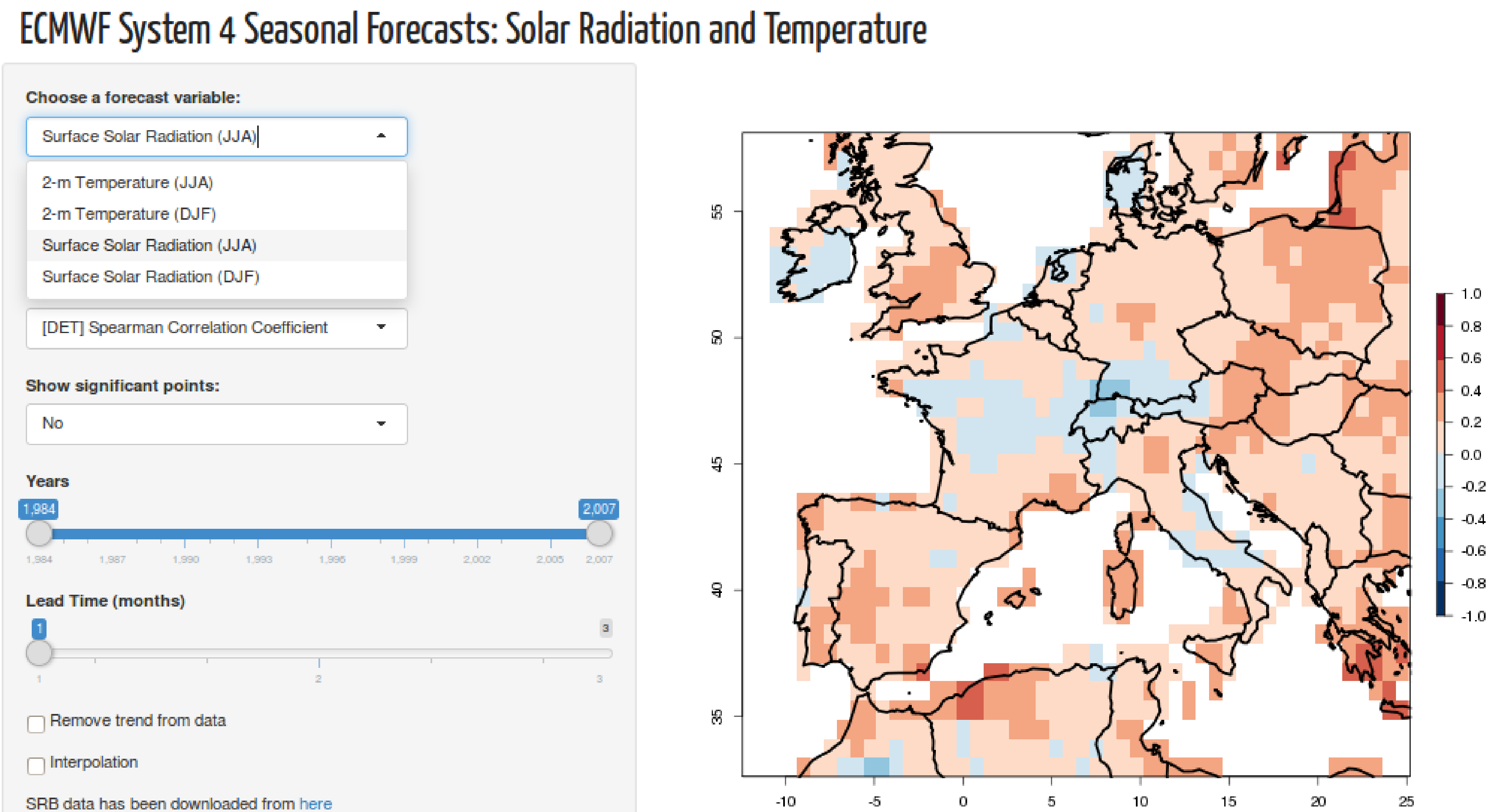
www.arecs.org, provide feedback, register your needs



Solar power production

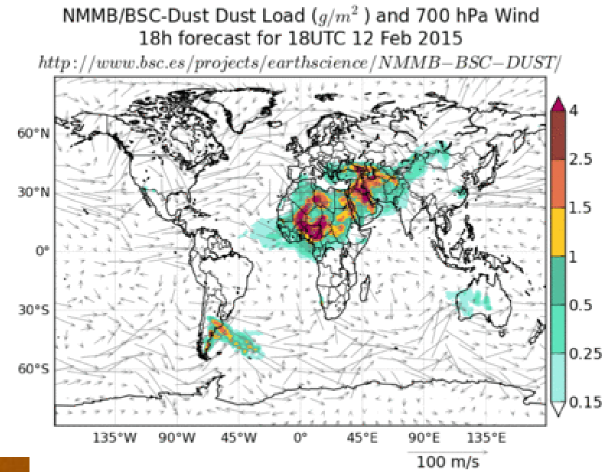
SPECS develops decision management tools for stakeholders:

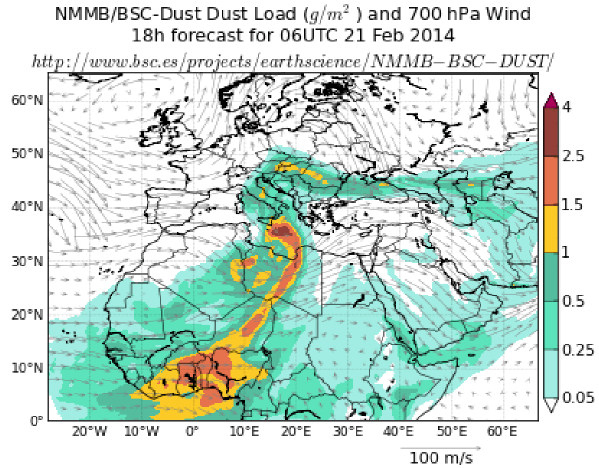
http://giotto.casaccia.enea.it/specs-solar/



Solar power production

BSC and AEMET manage the WMO SDS-WAS NAMEE Regional Center (http://sds-was.aemet.es) and the Barcelona Dust Forecast Center (http://dust.aemet.es). This effort contributes to solar energy management preventing energy loss and helping with the location of future plants.

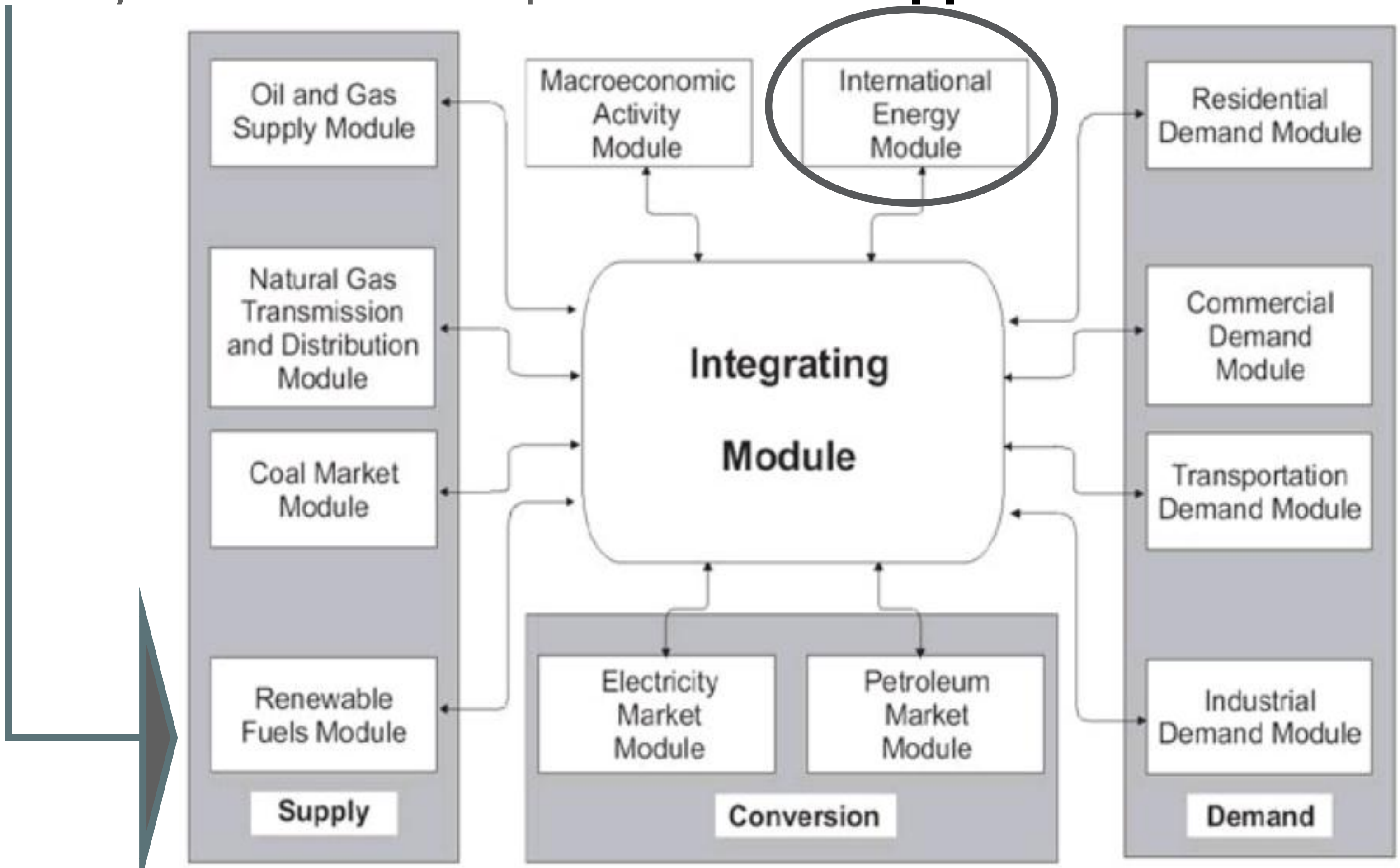




RE is just part of the story

Example of a national energy modelling system.

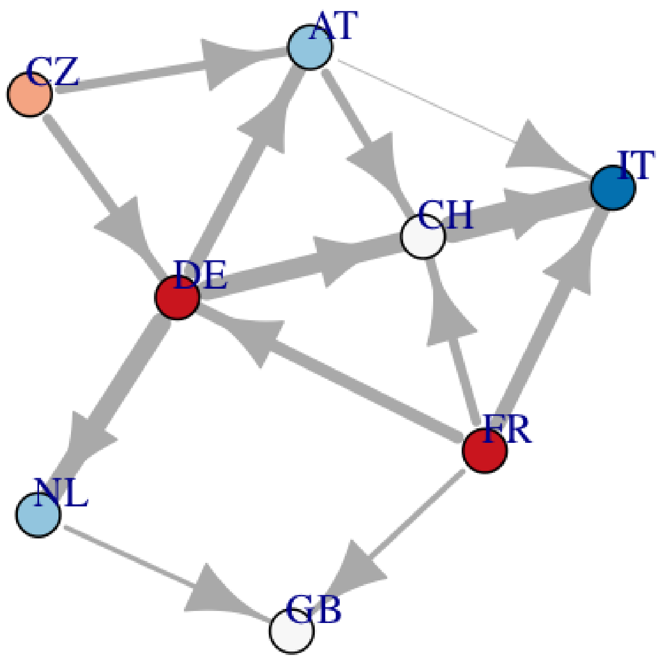
We only addressed this part. **Holistic approaches are needed.**

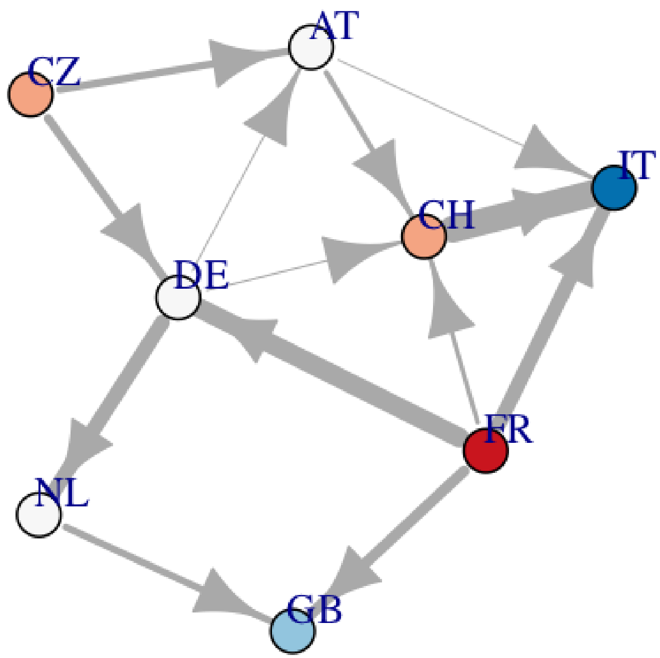


The role of energy export

European electricity flows for Jan-Feb (left) and June-July (right). Red nodes are the main exporters and blue the main importers. For clarity only the eight countries with the highest exchange are shown.

Data from ENTSO-E (2003-2014).





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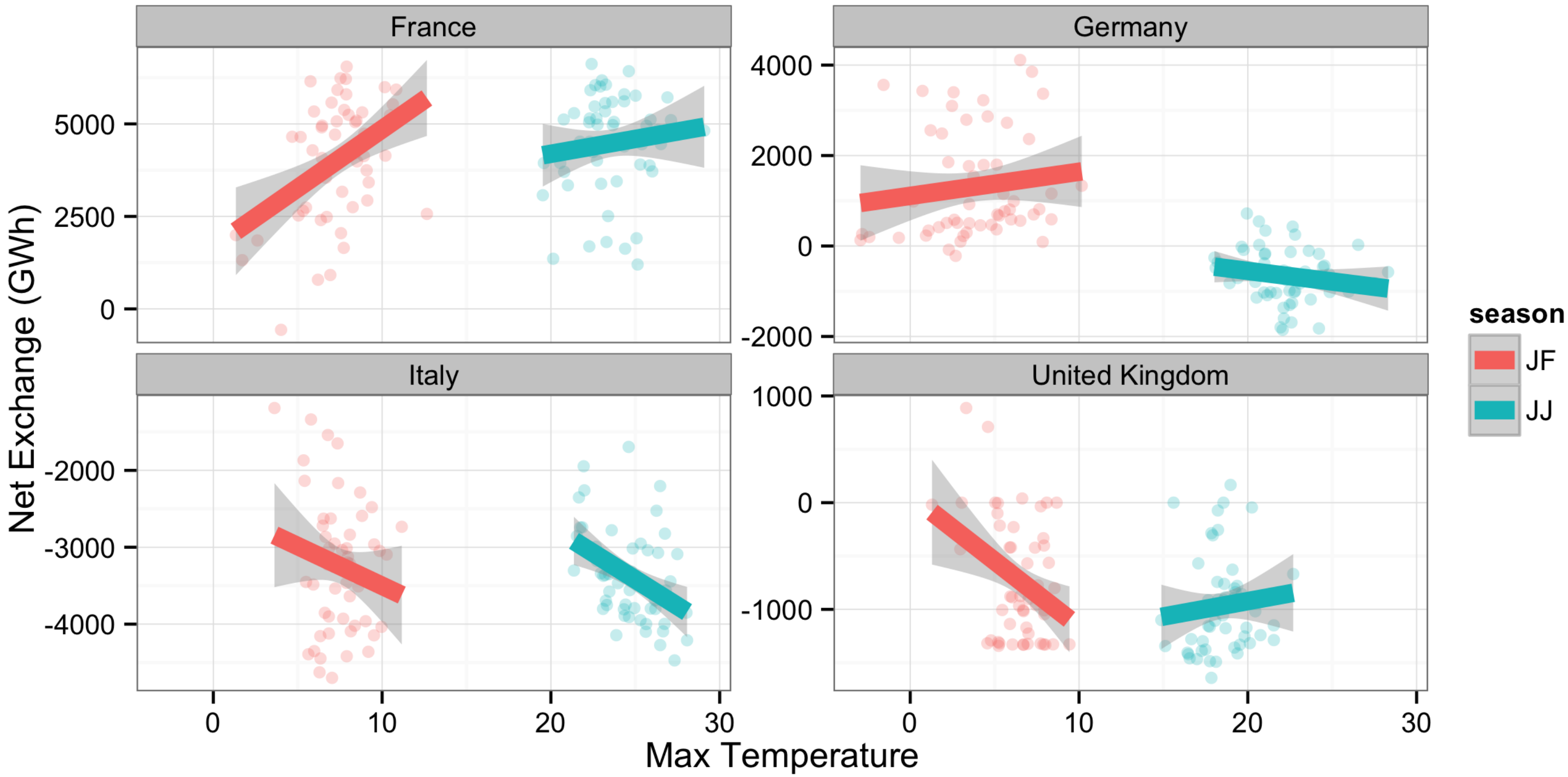
The role of energy export

Weather and climate affect exchanges via electricity demand (heating or cooling, from the customer point of view) and RE production.



Matteo De Felice (ENEA)

WCRP RCI Grand Challenge

Grand Challenge on Regional Climate Information: What gaps in our scientific understanding and information, if addressed, would maximise the value content of regional climate information?

Steering group: Clare Goodess (WGRC), Francisco Doblas-Reyes (WGSIP), Lisa Goddard (CLIVAR), Bruce Hewitson (WGRC), Jan Polcher (GEWEX & WGRC), supported by Roberta Boscolo (WCRP)

Initial case study for the city of Maputo (Mozambique)